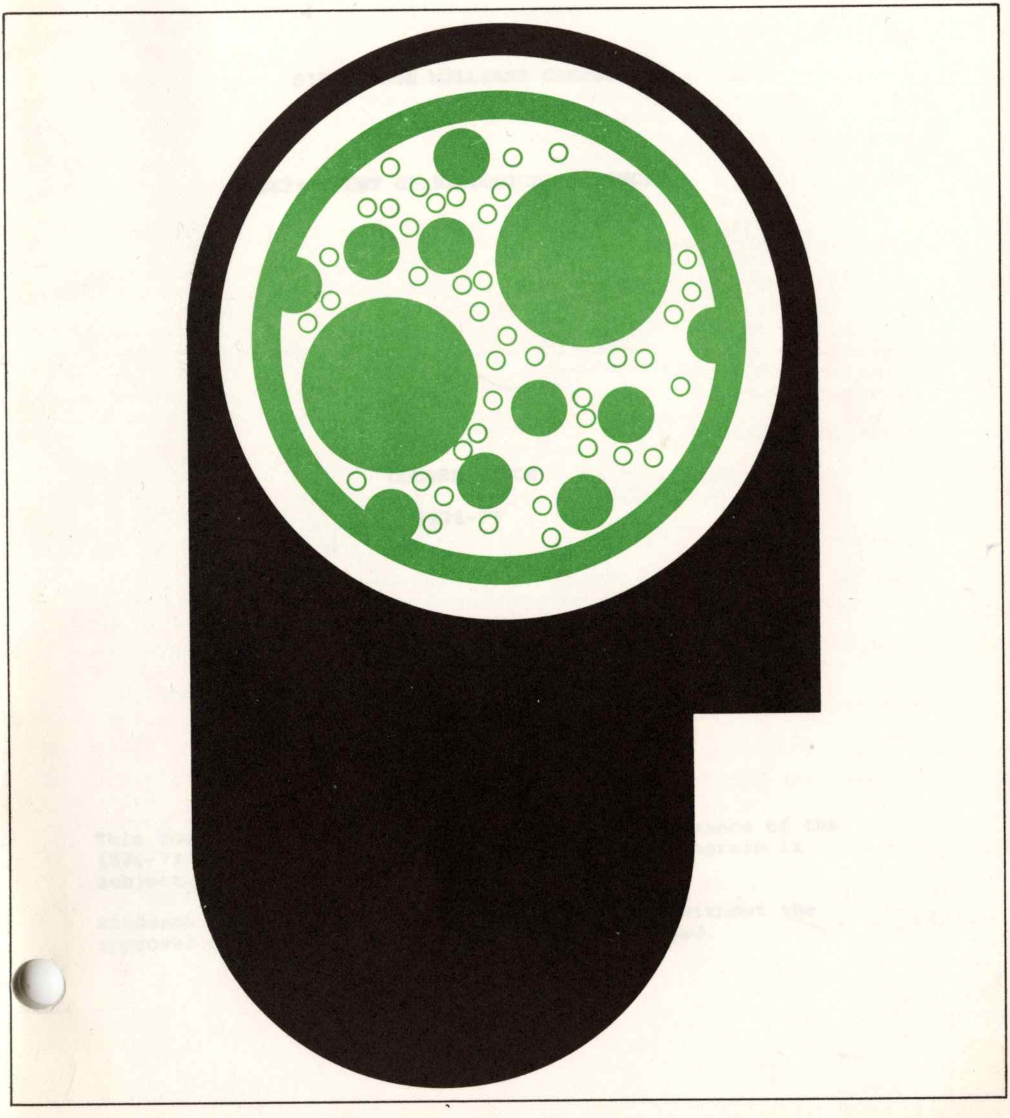
Science

1976/77

concordia
university

Sir George Williams
Faculty of Science

Biological Science



SIR GEORGE WILLIAMS CAMPUS

DEPARTMENT OF BIOLOGICAL SCIENCES

COURSE GUIDE

1976-77

This course guide has been prepared months in advance of the 1976-77 academic year and information contained herein is subject to change.

Students are advised not to purchase any texts without the approval of the department or professor concerned.

Full-Time Faculty

Associate Professor and Chairman
of Department

Hildegard E. Enesco, Ph.D. (Columbia)

Professor

Donald L. Peets, Professor of
Human Genetics, B.Sc. (McGill)

Associate Professors

Syamala S. Ashtakala, Ph.D. (Toronto)
Ragai K. Ibrahim, Ph.D. (McGill)
Gérard Leduc, Ph.D. (Oregon)
Ruth L. Lowther, Ph.D. (Toronto)
Frank C. MacLeod, Ph.D. (Minnesota)
Elaine B. Newman, Ph.D. (Radcliffe)
Robert M. Roy, Ph.D. (Toronto)

Assistant Professors

Perry D. Anderson, Ph.D. (Oregon)
Muriel Herrington, Ph.D. (McMaster)
Jack A. Kornblatt, Ph.D. (Cincinnati)
Edward J. Maly, Ph.D. (Princeton)
Enrique Preddie, Ph.D. (McGill)
Sylvia M. Ruby, Ph.D. (Western)

Research Associates

Ninfa Redmond, Ph.D. (Montreal)
Michael Giles, Ph.D. (British Columbia)

Lecturers

Dorothy Fry, M.A. (Missouri)
Margaret MacLeod, M.A. (British Columbia)

Information

The following members of the faculty advisors have responsibilities for the various programmes:

Honours Programme - Dr. S.S. Ashtakala - 879-4213

Specialized Majors and Minors Programme: Dr. P. Anderson - 879-7357
Dr. R.L. Lowther - 879-7290
Dr. C.F. MacLeod - 879-4222
Dr. E. Maly - 879-4129

If you are interested in talking about Biology to a faculty advisor, call one of the professors listed above or the Department office (879-2856).

Programmes

The Department of Biological Sciences offers a wide variety of courses in biology, botany and zoology, ranging from ecology and physiology to molecular genetics. Programmes are designed to give the student a broad scientific background and to allow specialization or diversification, according to the interests of individual students. Faculty advisors are ready to assist students in selecting the programme most suited to their individual interests and career plans. The following programmes are available:

Honours in Biological Sciences - 72 credits

The honours programme envisages not only a degree of specialization but also the attainment of a high academic standard. It is in this programme that students are given an opportunity to undertake individual supervised research in a course especially designed for that purpose. The honours programme attracts students interested in graduate studies or professional training.

Specialized Degree in Biological Sciences - 60 credits

The specialized degree programme introduces the student to all fundamental areas of biology, presented in a series of core courses. In addition to the core courses, the majors student takes additional credits in Biological Sciences or related subjects, chosen in consultation with a Faculty Advisor. This programme is especially interesting and useful to students who expect to teach or to work in laboratories.

Major in Biological Sciences - 36 credits
Major in Botany - 36 credits
Major in Cell and Molecular Biology - 36 credits
Major in Environmental Biology - 36 credits
Major in Zoology - 36 credits

Majors programmes allow an in depth study of one area of biological sciences. Students may combine 2 majors programmes in different departments, thus broadening their career opportunities. Some possible combinations of particular interest are:

- Major in Cell and Molecular Biology and Major in Biochemistry.
- Major in Environmental Biology and Major in Geology
- Major in Zoology and Major in Psychology.
- Major in Botany and Major in Geography

Minor in Biological Sciences - 24 credits
Minor in Botany - 24 credits
Minor in Cell and Molecular Biology - 24 credits
Minor in Environmental Biology - 24 credits
Minor in Zoology - 24 credits

These minor programmes are designed to familiarize science students with the fundamental aspects of various branches of modern biology. The minor programme may be combined with specialized programmes or majors programmes in other departments.

Minor in Life Sciences - 24 credits

This programme is designed to give the non-science student a basic familiarity with biological and environmental problems. There are no science prerequisites.

Activities

In addition to the formal programmes there are other activities in the Department of Biological Sciences that contribute to its dynamic atmosphere.

Active research is carried on by faculty and by graduate students enrolled in the Master of Science Option A programme. The three research areas of the department are: (1) Cell biology, including microbial physiology, radiation biology and cancer research, (2) Fisheries biology and water pollution studies (3) Plant physiology and plant biochemistry. All areas are supported by research grants and are publishing actively. Facilities include a modern greenhouse, water pollution laboratory and biochemical research laboratories.

The Master of Science Option B provides an M.Sc. in the Teaching of Biology. It is designed for Quebec high-school teachers and offers courses in modern biology and laboratory experimentation techniques.

Seminars are given every week by faculty, graduate students and honours students, and by invited speakers. Current topics and ongoing research are discussed and a wide variety of viewpoints examined. All students are welcome to participate in these seminars as well as to participate in the activities of the student organized Biology Club.

B.Sc. Specialized Degree in Biological Sciences

	Credits
Required Biology courses	48
Optional Biology courses	12
Optional courses in Biology or in any department	30
	90 Degree requirement

Students with specific interests or career objectives may choose their optional courses for an in-depth study of a specific area of Biology. The four areas of concentration available are:

1. Cell and Molecular Biology
2. Environmental Biology
3. Botany
4. Zoology

The courses suggested for each of these four concentrations are listed below.

All students completing the above Biology B.Sc. requirements receive the B.Sc. in Biological Sciences. The department will, in addition, provide a letter verifying that a student has taken a 24-credit concentration within the B.Sc. if the student so requests.

Suggested Courses for Concentration in Cell & Molecular Biology

Biology N253 - Biology of Bacteria & Viruses
Biology N350 - Immunology
Biology N360 - Developmental Biology
Biology N433 - Cytology
Biology N434 - Radiation Biology I
Biology N435 - Radiation Biology II
Biology N445 - Biological Regulatory Mechanisms
Biology N446 - Molecular Genetics
Biology N421 - Advanced Animal Physiology
Chemistry N471 - Advanced Biochemistry

Suggested Courses for Concentration in Environmental Biology

Biology N310 - Field Ecology
Biology N314 - Fundamentals of Limnology
Biology N381 - Biostatistics II
Biology N416 - Aquatic Ecology & Water Pollution
Botany N210 - Eastern North American Flora
Botany N216 - Biology of Algae
Botany N313 - Plant Ecology
Botany N421 - Physiology of Stress in Plants
Zoology N212 - Invertebrate Zoology
Zoology N313 - Animal Ecology
Zoology N317 - Biology of Fishes
Geography N371 - Biogeography
Geography N357 - Resource Utilization and Conservation
Interdisciplinary Studies N221 - Environmental Issues I
Physics N273 - Energy and Environment
Biology N254 - Biology of Fungi

Suggested Courses for Concentration in Zoology

Zoology N212 - Invertebrate Zoology
Zoology N213 - Parasitology
Zoology N215 - Chordate Anatomy
Zoology N313 - Animal Ecology
Zoology N317 - Biology of Fishes
Zoology N320 - Animal Physiology
Zoology N331 - Fundamentals of Histology
Zoology N332 - Comparative Vertebrate Histology
Zoology N361 - Vertebrate Embryology
Zoology N422 - Advanced Animal Physiology
Biology N344 - Genetics of Higher Organisms
Biology N350 - Immunology
Biology N351 - Nutrition

Suggested Courses for Concentration in Botany

Botany N210 - Eastern North American Flora
Botany N213 - Economic Botany
Botany N216 - Biology of Algae
Botany N231 - Plant Anatomy
Botany N311 - Plant Biosystematics
Botany N313 - Plant Ecology
Botany N320 - Plant Metabolism
Botany N360 - Physiology of Plant Growth
Botany N421 - Physiology of Stress in Plants
Botany N422 - Plant Biochemistry
Biology N254 - Biology of Fungi

Student's attention is directed toward the following courses of direct interest to Biology:

Chemistry N351 - Theory and Practice of Biochemical Techniques
Geology N420 - Paleontology
Mathematics N210 - Biomathematics
Psychology N461 - Physiological Psychology
Geography N371 - Biogeography

BIOLOGY N201 (251)
GENERAL BIOLOGY I (3 credits)

Instructor: T.B.A.

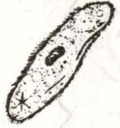
Description: A survey of basic principles of Biology: chemical basis of life, cell organization and control; elements of anatomy, physiology, morphogenesis, heredity and evolution. Lectures and Laboratories.

Text: To be announced.

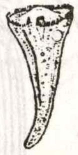
Assignments & Grading:		
	Laboratory	Required to pass the course
	Mid-term examination	35%
	Final examination	65%

Prerequisite: None

NOTE: Students who have credits for CEGEP Biology 301 may not take this course for credits.

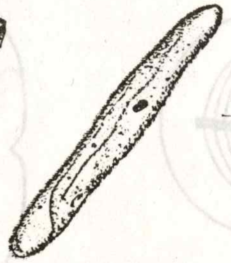


Paramecium



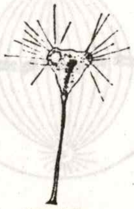
Stentor

Amoeba



Spirostomum

Colpoda



Tokophrya

BIOLOGY N202 (252)
GENERAL BIOLOGY II (3 credits)

Instructor: J.A. Kornblatt

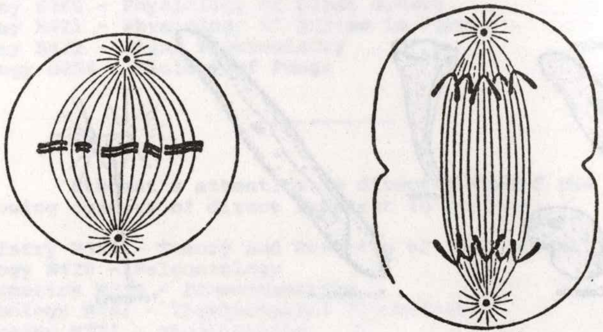
Description: Cell biology, elementary biochemistry, developmental biology, physiology and genetics. Lectures and Laboratory.

Text: No required text.

Assignments & Grading:	Term grade	50% - mid-term examination 50% - laboratory examination
	Final	50% - term grade 50% - final examination

Prerequisite: Biology N201 or equivalent.

NOTE: Students who have credits for CEGEP Biology 401 or equivalent may not take this course for credits.



BIOLOGY N203 (253)
ANIMAL BIOLOGY (3 credits)

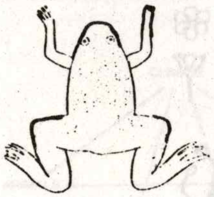
Instructor: C.F. MacLeod

Description: A survey of the major evolutionary trends of the animal kingdom, the diversity among animals and the means by which animal groups meet the environmental demands of the habitat in which they live.

Text: "General Zoology", 4th edition, Villee, Walker, Barnes.

Assignments & Grading:	Final examination	50%
	Laboratory examination	50%

Prerequisite: CEGEP Biology 301 or equivalent.



BIOLOGY N204 (254)
PLANT BIOLOGY (3 credits)

Instructor: Ruth L. Lowther

Description: A survey of the major evolutionary trends in the plant kingdom. The integration of structure and function in relation to plant growth and evolution will be stressed. Lectures and Labs.

Text: T.B.A.

Assignments & Grading: Mid-term (30%) and final (70%) examinations.

Prerequisite: CEGEP Biology 301 or equivalent.

BIOLOGY N213 (453)
FUNDAMENTALS OF ECOLOGY (3 credits)

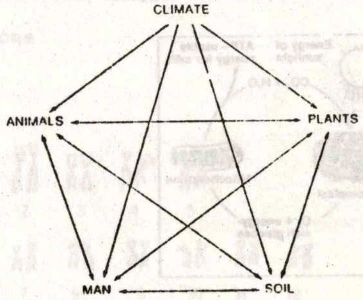
Instructor: C.F. MacLeod
E. Maly

Description: An introduction to the basic principles of ecology dealing with the most important components of ecosystems. The course illustrates how environmental factors determine the distribution and abundance of plants and animals in various aquatic and terrestrial biomes of the world. Ecological implications of environmental perturbation. Lectures only.

Text: To be announced

Assignments & Grading: Mid-term and final examinations.

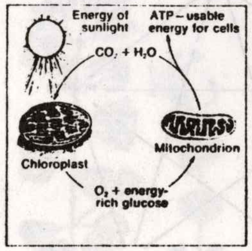
Prerequisite: CEGEP Biology 301 or equivalent.



BIOLOGY N224 (444)
CELL PHYSIOLOGY (3 credits)

Instructor: J.A. Kornblatt

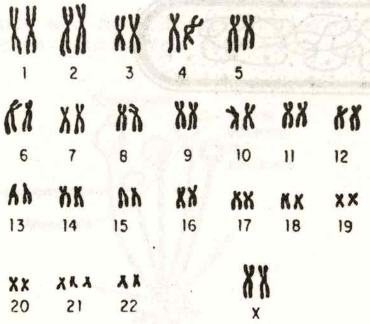
Description:	A survey of the mechanisms involved in the normal function of single cells and subcellular components, particularly organelles as well as their responses to environmental stress. Lectures and Laboratories.
Text:	"Cell Physiology" by A. Giese, 4th ed.
Assignments & Grading:	30% Final examination 15% Mid-term examination 45% Laboratory reports 10% Laboratory tests
Prerequisite:	CEGEP Biology 401 or Biology N202 and Chemistry N231, previously or concurrently.



BIOLOGY N241 (241)
GENETICS AND HUMAN WELFARE (6 credits)

Instructor: D.L. Peets

Description:	A course on the principles of heredity as understood by modern biology. It deals also with the application of genetic principles to organisms, including man. The biological basis of social problems is dealt with at some length. Lectures only.
Text:	Schaums Outline Series Genetics, by William D. Stanfield. McGraw-Hill (Paper).
Assignments & Grading:	Grades are compiled from results of periodic quizzes plus comprehensive examinations in December on material from the first term, and in April on material from the second term, but this plan might be altered by recommendations from the class.
Prerequisite:	None



BIOLOGY N253 (428)
BIOLOGY OF BACTERIA AND VIRUSES (3 credits)

Instructor: E.B. Newman

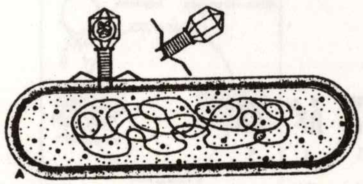
Description: An introduction to theoretical and applied aspects. The physiology of bacteria and viruses as related to industrial, health, agricultural and ecological considerations is discussed. Lectures and Laboratories.

Text: "The Microbial World", by Stanier, Adelberg and Doudoroff OR "Microbiology" by Brock.

Assignments & Grading:
50% on final examination - short answers/essay
25% on laboratory work - reports and examination
25% on term paper and 2 short reports

Prerequisite: CEGEP Biology 301 or permission of the instructor.

NOTE: Students who have credits for Biology N250 (Botany 414) may not take this course for credits.



BIOLOGY N254 (429)
BIOLOGY OF THE FUNGI (3 credits)

Instructor: Ruth L. Lowther

Description: A study of selected species from representative groups including their occurrence, life-cycles and growth requirements. In lectures, stress is placed on their activities - in cycling of elements in nature, in damage to agricultural crops and forests, in food spoilage, as human pathogens, as industrial agents, as research tools, and as sources of food and drugs. Labs are mostly descriptive using Canadian collections. Lectures and Labs.

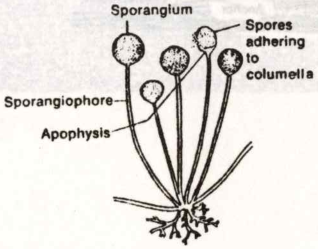
Field Trip: A one-day week-end field trip is compulsory.

Text: "Introductory Mycology", 2nd ed. by Alexopoulos, John Wiley and Sons, 1962.

Assignments & Grading: There will be a mid-term (30%) and a final (70%) examination.

Prerequisite: CEGEP Biology 301, equivalent or permission of the instructor.

NOTE: Students who have credits for Biology N250 (414) may not take this course for credits.



BIOLOGY N310
FIELD ECOLOGY (3 credits)

Instructor: E. Maly

Description: Field and laboratory investigations of factors affecting distribution and abundance of organisms. Four Saturday field trips. Methods of analysis of field data, and laboratory methods in ecology. Group and individual laboratory projects.

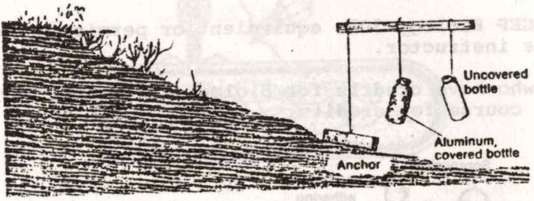
Text: "Manual of Field Biology and Ecology", by A.H. Benton and W.E. Werner, Jr., 5th ed.

"A Guide to the Study of Freshwater Biology", by J.G. Needham and P.R. Needham.

Assignments & Grading: No examination. 50% for laboratory and field work, 50% for reports and presentations.

Prerequisite: Biology N213.

Recommended Prerequisite: Biology N380 and Botany N210.



BIOLOGY N314 (454)
FUNDAMENTALS OF LIMNOLOGY (3 credits)

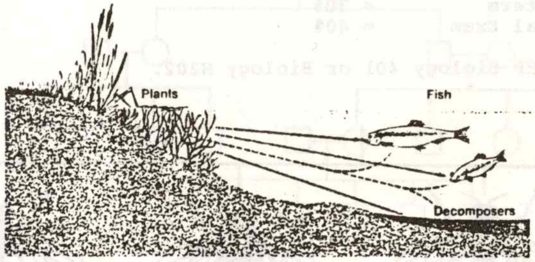
Instructor: G. Leduc

Description: An introduction to the study of freshwater ecosystems with major emphasis on geographical, physical and chemical characteristics. The major topics include the origin of lake basins, lake morphology and morphometry, wave and currents, the optical and thermal properties of lakes, dissolved chemicals. Lectures only.

Text: "Ecology of Inland Waters and Estuaries", by George K. Reid, Van Nostrand, Reinhold Co.

Assignments & Grading: 100% for final examination.

Prerequisite: Biology N213 previously or concurrently.



BIOLOGY N343 (445)
GENETICS (3 credits)

Instructor: H. Enesco

Description: A course to illustrate the fundamental principles of inheritance in plants, animals and microorganisms. Mendelian genetics, gene linkage and mutation will be covered. The role of DNA as the hereditary material and genetic code will be studied in detail, as will the mechanisms of DNA, RNA and protein synthesis. Lectures and Labs.

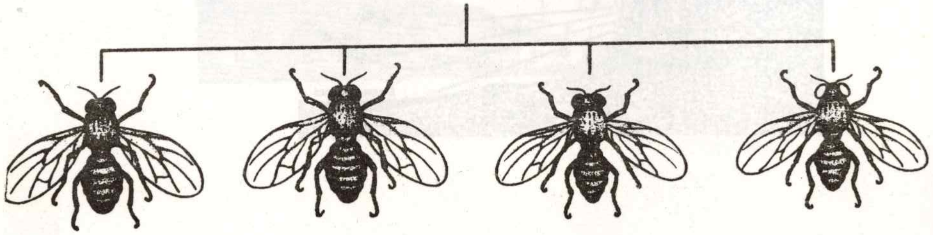
Texts: T.B.A.

Lab Manual: Sir George Williams Genetics Laboratory Manual by H. Enesco.

Assignments & Grading: Midterm and final examinations are schedueled. All examinations contain at least 60% I.B.M. questions. Essays, short answer questions or genetic problems may also appear on examinations. Eleven laboratory reports are required.

Lab grade	=	30%
Midterm	=	30%
Final Exam	=	40%

Prerequisite: CEGEP Biology 401 or Biology N202.



BIOLOGY N344 (446)
GENETICS OF HIGHER ORGANISMS (3 credits)

Instructor: T.B.A.

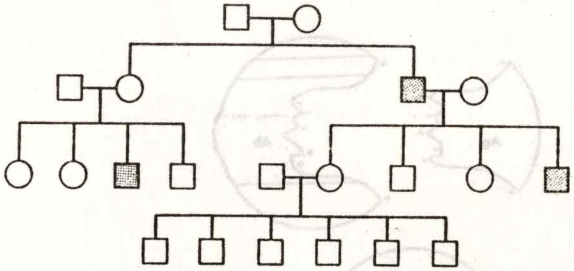
Description: This course will cover various aspects of the genetics of multicellular and eukaryotic organisms, including cytogenetics, developmental, human, behavioural and population genetics, as well as somatic cell genetics. Lectures only.

Text: To be announced.

Assignments & Grading: Midterm and final examinations.

Prerequisite: Biology N343.

NOTE: Students who have credits for Biology N342 (442) may not take this course for credits.



BIOLOGY N350
IMMUNOLOGY (3 credits)

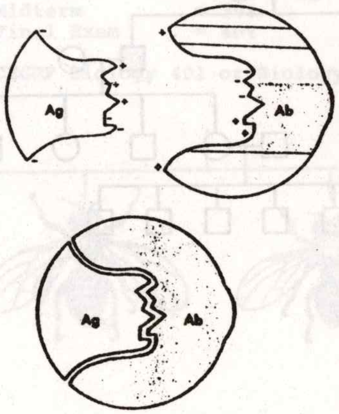
Instructor: J.A. Kornblatt

Description: A course in modern immunology stressing the following areas of study: the structure and properties of antigens and antibodies; the nature of the immune response; cellular antibody synthesis; genetic aspects of antibody synthesis; theories relating antibody specificity to genetic potential. Lecture and Conference.

Text: T.B.A.

Assignments & Grading:	Mid-term examination	50%
	Final examination	50%

Prerequisite: Biology N224, N343 and Chemistry N231. Chemistry N371 previously or concurrently.



BIOLOGY N351
NUTRITION (3 credits)

Instructor: N. Redmond

Description: The concept of a balanced diet will be studied in relation to calory content, and to protein, lipid, carbohydrate, vitamin and mineral requirements. The consequences of dietary deficiencies will be examined. Special topics such as dieting, organic foods and megavitamins will be discussed and evaluated. Lecture only.

Text: T.B.A.

Assignments & Grading: Will be discussed in class.

Prerequisite: Biology N202 previously or concurrently.

BIOLOGY N360 (460)
DEVELOPMENTAL BIOLOGY (3 credits)

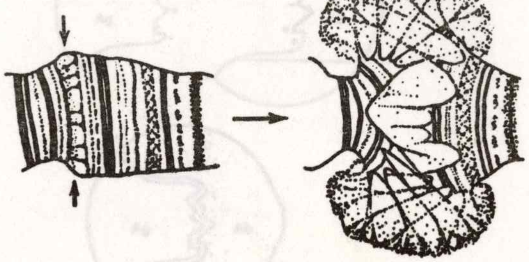
Instructor: E. Preddie

Description: The course involves a study of the molecular aspects of the nature of mechanisms controlling the organization of the complex process of development and differentiation. Topics range from morphogenesis of plant viruses through molecular genetic mechanisms of morphogenesis and intracellular biochemical differentiation of monochromosomal cells to functional differentiation of chromosomes and the biochemical physiological and morphological realization of the morphogenetic program in selected plants and animals.

Text: None. A complete list of required and recommended readings will be supplied.

Assignments & Grading: There will be a two hour mid-term examination and a three hour final examination.

Prerequisite: Second year standing in Biology Majors Program or permission of the instructor.



BIOLOGY N372 (481)
HISTORY OF BIOLOGY (3 credits)

Instructor: D.L. Peets

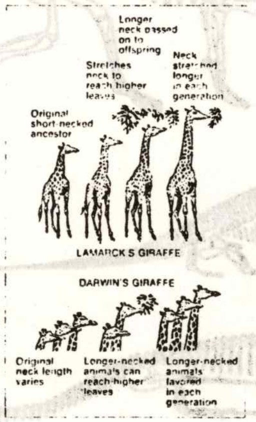
Description: A course following the growth of Biological Sciences. Lectures only.

Text: No specific text. Suggested readings will be recommended at intervals.

Assignments & Grading: No formal examinations will be held, grades being assessed on the basis of term papers, and/or seminars, and/or participation.

Prerequisite: Any 12 credits from the Department of Biological Sciences.

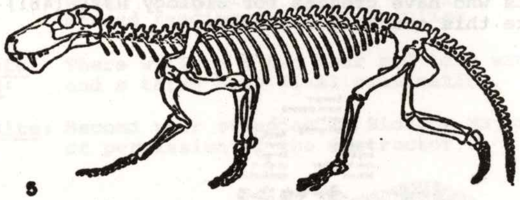
NOTE: Students who have credits for Biology N371 (481) may not take this course for credits.


Longer neck passed on to offspring
Stretches neck to reach higher leaves
Neck stretched longer in each generation
Original short-necked ancestor
LAMARCK'S GIRAFFE
DARWIN'S GIRAFFE
Original neck length varies
Longer-necked animals can reach higher leaves
Longer-necked animals favored in each generation

BIOLOGY N373 (484)
EVOLUTION (3 credits)

Instructor: D.L. Peets

Description:	A course to examine the concepts leading from Darwin's Theory to a modern synthesis of evolution. Lectures only.
Text:	"Evolution" by Charlotte J. Avers. Harper & Row (Paper).
Assignments & Grading:	No examination. Term paper and/or seminar.
Prerequisite:	Any 12 credits in the Department of Biological Sciences.



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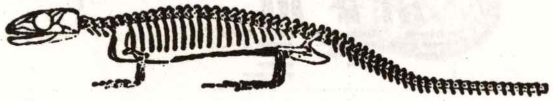

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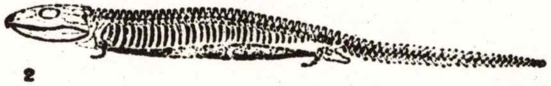

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BIOLOGY N380 (482)
BIOSTATISTICS I (3 credits)

Instructor: T. Dwivedi

Description:	Application of statistical methods to biological data. Descriptive statistics. Binomal, Poisson and Normal distributions. Confidence limits. Tests of significance. Introduction to analysis of variance, correlation and regression. Analysis of frequencies. Lectures and laboratories.
Text:	To be announced.
Assignments & Grading:	Laboratory work and quizzes = 50% Final examination = 50%
Prerequisite:	Second year standing.

BIOLOGY N381 (483)
BIOSTATISTICS II (3 credits)

Instructor: T. Dwivedi

Description: Sampling methods. Analysis of variance and experimental design. Regression and correlation techniques. Bioassay. Non-parametric statistics. Analytical methods in field biology/genetics and microbiology. Lectures and laboratories.

Text: To be announced.

Assignments & Grading:
Laboratory work and quizzes = 50%
Final examination = 50%

Prerequisite: Biology N380.

BIOLOGY N416 (456)
AQUATIC ECOLOGY AND WATER POLLUTION (3 credits)

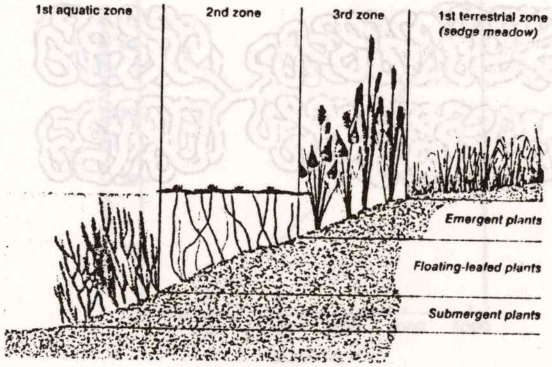
Instructor: G. Leduc

Description: An inquiry into factors governing the distribution and abundance of aquatic organisms in lakes and streams, with emphasis on the nature and significance of the responses of aquatic organisms and communities through changes in water quality with pollution, on sources and types of pollutants and on methods of evaluating pollution and treating wastes. Lectures only.

Text: "Biology and Water Pollution Control", by C.E. Warren, Saunders, 434p.

Assignments & Grading: 65% for the final examination and 35% for term paper and seminar if number of students permits.

Prerequisite: Biology N314.



BIOLOGY N433 (443)
CYTOLOGY (3 credits)

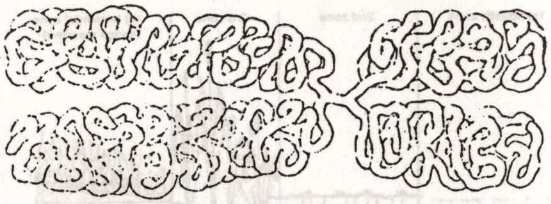
Instructor: H. Enesco

Description: This course is designed as an integrated study of the structure and function of plant and animal cells, based on electron microscopic, cytochemical and biochemical analysis. Chromosome structure is analyzed in relation to genetic function. Cell organelles, including lysosomes, Golgi apparatus, mitochondria, chloroplasts, ribosomes and membranes are analyzed in relation to the functional activities of the cell.

Text: "Cell Biology", by DeRobertis, Saez and DeRobertis, 6th ed., 1975, W.B. Saunders Co.

Assignments & Grading: Mid-term and final examinations.

Prerequisite: CEGEP Biology 401 or Biology N202 and Chemistry N231.



BIOLOGY N434 (434
RADIATION BIOLOGY AND RADIOTRACER METHODOLOGY I (3 credits)

Instructor: R.M. Roy

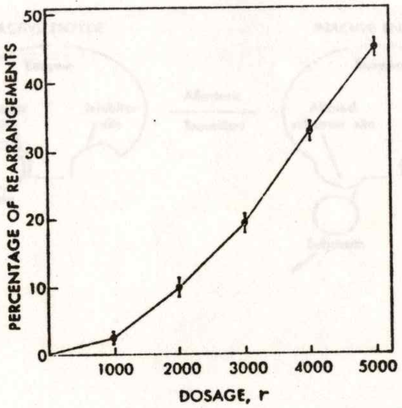
Description: A survey of the elements of radiation physics with emphasis on the properties of ionizing radiation and its interaction with matter including dosimetry and methods of radiation counting. The effects of radiation at the macromolecular, cellular and organismal level will be considered from both the somatic and genetic points of view. Lectures and Labs.

Texts: "Ionizing Radiation and Life" by Victor Arena.

Assignments & Grading:

Essay	20%
Lab project	20%
Lab reports	60%
Final mark	= 100%

Prerequisite: Biology N224 previously or concurrently, 2nd or 3rd year standing.



BIOLOGY N435 (435)
RADIATION BIOLOGY AND RADIOTRACER METHODOLOGY II (3 credits)

Instructor: R.M. Roy

Description: A detailed study of selected topics in chemical and solid state dosimetry, liquid scintillation counting, neutron irradiation techniques, cell kinetics, target theory, radiation botany and mammalian radiobiology. Laboratory will emphasize the use of a wide range of radioisotopes and radiation sources. A visit to a major radiation lab or reactor will be arranged.

Text: "Ionizing Radiation and Life" by Victor Arena.

Assignments & Grading	Essay	20%
	Lab project	20%
	Lab reports	60%
	Final mark =	100%

Prerequisite: Biology N434.

BIOLOGY 445 (447)
BIOLOGY REGULATORY MECHANISMS - 3 credits

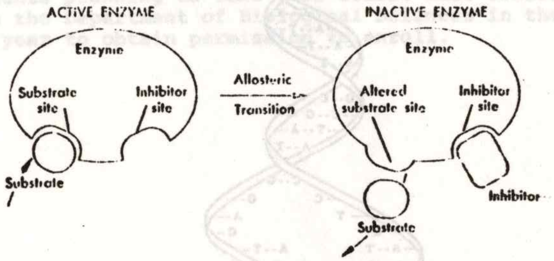
Instructor: E.B. Newman

Description: Metabolic pathways with an emphasis on their control and coordination; molecular mechanisms used in the integration of metabolic pathways. Course stresses the development of students' analytic and critical facilities.

Text: No textbook required, readings will be supplied.

Assignments & Grading:
Written papers (3) = 20-30%
Final examination = 70-80%
Mid-term examination: counts only if grade is higher than the final examination.

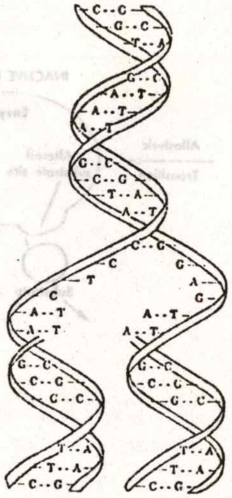
Prerequisite: Chemistry N371 previously or concurrently; Biology N342 or N343 and N344, both suggested but not required.



BIOLOGY 446 (448)
MOLECULAR GENETICS (3 credits)

Instructor: E.B. Newman

Description:	Topics in molecular genetics: mechanism of biosynthesis of DNA; RNA polymerase; selectivity problems (operators, promoters); bacteriophage genetics.
Text:	No textbook required, readings will be supplied.
Assignments & Grading:	3 examinations corresponding to the 3 parts of the course and worth 25% each. Written paper worth 25%.
Prerequisite:	Biology N342 or N344 or permission of the instructor. Chemistry N371 previously or concurrently is suggested but not required.



BIOLOGY N490 (491)
SPECIAL STUDY (6 credits)

Coordinator: P.D. Anderson

Description:	In this course, the student undertakes a special research project to develop his knowledge of scientific procedures as used by biologists. The project may include only library research or both library and experimental research.
Text:	No textbook required.
Assignments & Grading:	Students are required to submit a written research report on their work and to make an oral presentation at a departmental seminar.
Prerequisite:	3rd year standing and permission from the Chairman of the Department or his/her representative.

NOTE: Preference will be given to Honours students.

Students planning to take this course must consult with the Department of Biological Sciences in their U-2 year to obtain permission to enroll.

BOTANY N210 (430)
EASTERN NORTH AMERICAN FLORA (3 credits)

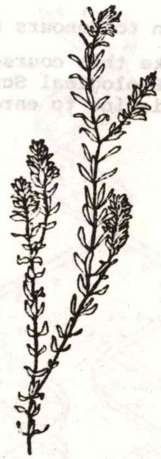
Instructor: Ruth L. Lowther

Description: A study of higher plant life occurring in Eastern North America, including their recognition, collection, identification, classification and distribution. Field work for practical experience with the regional flora in various habitat. Lectures and laboratories.

Text: T.B.A.

Assignments & Grading: 1 mid-term examination (30%) and 1 final examination (60%).

Prerequisite: Biology N204 previously or concurrently.



BOTANY N213 (421)
ECONOMIC BOTANY (3 credits)

Instructor: Ruth L. Lowther

Description: Origin, development and use of selected economic plants including microorganisms. Their historical impact, prospects for future use and importance to Canadian economy are stressed as well as world-wide problems of food and alimentation. Lectures only.

Text: "Plants for Man", by Schery, 2nd ed. 1972. Prentice-Hall.

Assignments & Grading: A mid-term (30%) and a final (70%) examination.

Prerequisite: CEGEP Biology 301, equivalent or permission of the instructor.

BOTANY N216 (435)
BIOLOGY OF FRESH WATER AND MARINE ALGAE (3 credits)

Instructor: Ruth L. Lowther

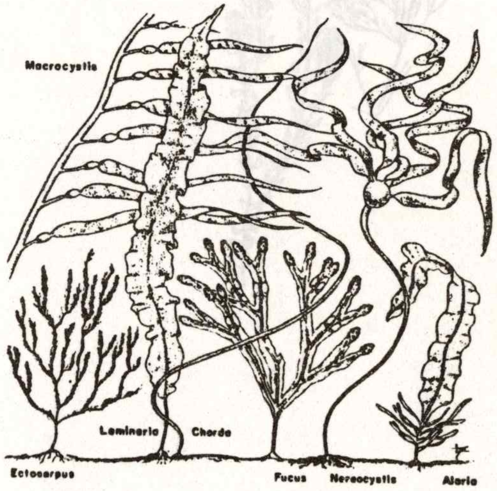
Description: A study of selected species from representative freshwater and marine groups including their occurrence, life-cycles and growth requirements. Topics include their involvement - in polluted and non-polluted water systems, in sewage treatment, as primary producers in food chains, in the formation of natural habitats, as special research subjects as well as their increasing economic importance in industry and as food supplements. Labs are mostly descriptive using Canadian collections. Lectures and laboratories.

Text: T.B.A.

Assignments & Grading: There will be a mid-term (30%), and a final examination (60%).

Prerequisite: CEGEP Biology 301 or equivalent.

NOTE: Students who have credits for Botany N212 (415) may not take this course for credits.



BOTANY N231 (410)
PLANT ANATOMY (3 credits)

Instructor: S.S. Ashtakala

Description: A study of the internal structure of the plant as related to the processes of growth and metabolism. An experimental approach is presented to the study of the relationship between structure and function of various parts of the plant. Topics include developmental, pathological, ecological and economic aspects of anatomy as well as its practical applications in horticulture such as pruning, grafting, wound healing, etc. Lectures and Laboratory.

Laboratory work requires preparation of permanent slides by plant microtechnique.

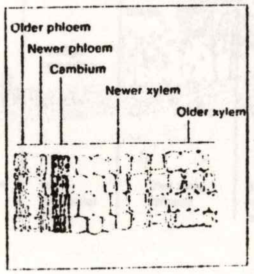
Text: "Anatomy of Seed Plants", by K. Esau. J. Wiley & Sons.

Assignments & Grading:

Laboratory work	10%
Slides (Freehand & Microtome	20%
Lab test (1)	10%
Class test (1)	10%
Final examination	50%
Final mark	100%

Prerequisite: Botany N204

NOTE: Students who have credits for Botany N230 (421) may not take this course for credits.



BOTANY N311
PLANT BIOSYSTEMATICS (3 credits)

Instructor: S.S. Ashtakala

Description: A study of modern systematics concerned with the application of experimental techniques in genetics, cytology, biochemistry and statistics to the solution of problems concerning relationships among various plant taxa, their classification and evolutionary sequences. Lectures and Laboratory.

Laboratory work involves an independent project on local taxa, their morphology and anatomy along with a comparative study of their relationships by applications of root tip and meiotic chromosome study, TLC of leaves and flowers, and gel electrophoretic study of seed proteins.

Text: "Principles and Methods of Plant Biosystematics", by O.T. Solbrig. MacMillan Co.

Assignments & Grading:

Seminars	20%
Laboratory project	50%
Class test	30%
Final mark	100%

Prerequisite: Biology N204.

NOTE: **Students who have credits for Botany 411 may not take this course for credits.**

BOTANY N313 (423)
PLANT ECOLOGY (3 credits)

Instructor: E. Maly

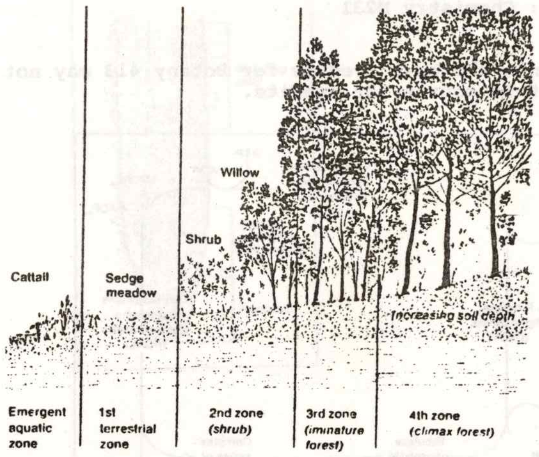
Description: Dynamic effects of physical and biotic factors on vegetation: succession, climax and influence of man. Elements of experimental ecology and field biology from the autecological to the phytogeographical level. Lecture only.

Text: Oosting, H.J. "Study of Plant Communities". Kershaw, K.A. "Quantitative and Dynamic Plant Ecology" (2nd edition).

Assignments & Grading: 1 mid-term, 1 final examination and 2 term papers.

Prerequisite: Biology N204 and N213.

NOTE: Students who have credits for Botany N312 may not take this course for credits.



BOTANY N320 (431)
PLANT METABOLISM (3 credits)

Instructor: S.S. Ashtakala

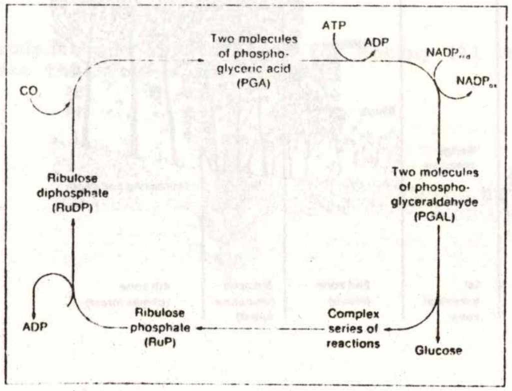
Description:	A study of the physiological processes of higher plants related to nutrition and metabolism. Topics include: absorption and transport of water and mineral salts, mineral nutrition, photosynthesis, carbohydrates and nitrogen metabolism. Interrelations among the various metabolic processes and their relationship to growth and development are emphasized. Lectures and Laboratory.
Text:	"Plant Physiology", by R.M. Devlin, 1974. 3rd edition. Van Nostrand.

Assignments & Grading:

Laboratory work and reports	30%
Class test	20%
Final Examination	50%
Final mark	100%

Prerequisite: Chemistry N231

NOTE: Students who have credits for Botany 413 may not take this course for credits.

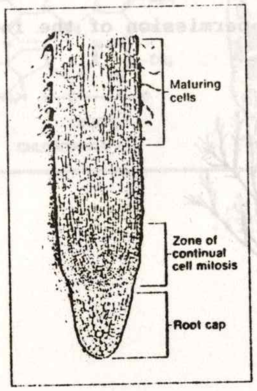

ATP
ADP
Two molecules of phosphoglyceric acid (PGA)
$NADP_{red}$
$NADP_{ox}$
CO
Ribulose diphosphate (RuDP)
Two molecules of phosphoglyceraldehyde (PGAL)
ADP
Ribulose phosphate (RuP)
Complex series of reactions
Glucose

BOTANY N360 (432)
PHYSIOLOGY OF PLANT GROWTH (3 credits)

Instructor: R.K. Ibrahim

Description:	A physiological and biochemical study of growth regulators, their mechanism of action and their role in plant growth and metabolism. Lectures and laboratories.
Text:	"The Control of Growth and Differentiation in Plants", by Wareing and Phillips, 1970. Pergamon Press.
Assignments & Grading:	Mid-term class test as well as a final examination.
Prerequisite:	Botany N320 previously or concurrently.

NOTE: Students who have credits for Botany 413 may not take this course for credits.



BOTANY N421
PHYSIOLOGY OF STRESS IN PLANTS (3 credits)
Instructor: S.S. Ashtakala

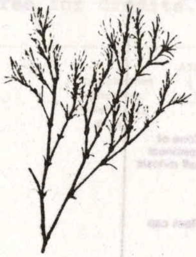
Description: An advanced study related to the physiological and molecular basis of plant response to various environmental stresses such as freezing, drought, soil toxicants, environmental pollutants and radiation effects. The study of the control of such stresses and of the injuries they produce; resistance, tolerance and avoidance mechanisms that exist are discussed. Response of crop plants and effects on crop quality and crop yield are discussed. Lectures only.

Text: None. Readings will be supplied.

Assignments & Grading:

Seminars (2)	35%
Term paper (2)	35%
Class test	30%
Final mark	100%

Prerequisite: Botany N320 or permission of the instructor



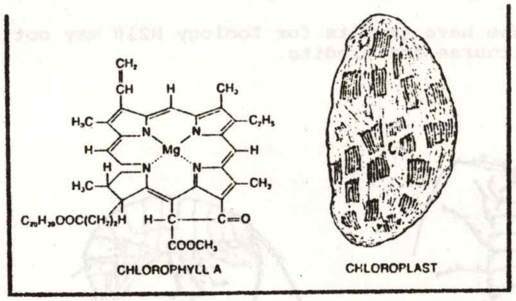
BOTANY N422 (418)
PLANT BIOCHEMISTRY (6 credits)
Instructor: R.K. Ibrahim

Description: Biochemical study of the common natural plant constituents including secondary metabolites, their biosynthesis and role in plant metabolism. Lectures only.

Text: "Introduction to Plant Biochemistry", by Goodwin and Mercer, 1972. Pergamon Press.

Assignments & Grading: Mid-term and final examinations.

Prerequisite: Biology N204 and Chemistry N231.



ZOOLOGY N212
INVERTEBRATE ZOOLOGY (3 credits)

Instructor: S.M. Roby

Description: A lecture and seminar course dealing with selected topics of current interest among invertebrates.

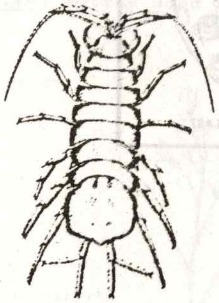
Text: No specific text required.

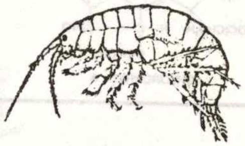
Assignments & Grading:

Final examination	35%
Seminar	30%
Laboratories	35%

Prerequisite: Biology N203 previously.

NOTE: Students who have credits for Zoology N210 may not take this course for credits.





ZOOLOGY N213 (424)
PARASITOLOGY (3 credits)

Instructor: M. MacLeod

Description: A survey of the parasitic groups of invertebrates with special reference to the parasites of man. Lectures and laboratories.

Text: "Introduction to Parasitology", by Asa Chandler, C.and Clark P. Read.

Assignments & Grading: Final essay examination only.

Prerequisite: Biology N203 previously or concurrently.

ZOOLOGY N215 (422)
CHORDATE ANATOMY (3 credits)

Instructor: C.F. MacLeod

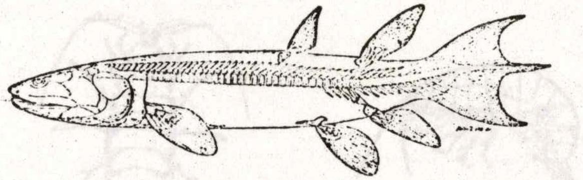
Description: A study of the anatomy and evolutionary development of the major organ systems of the chordates. In the laboratory the lamprey, the mudpuppy, the turtle and the cat will be dissected. Lectures and Laboratories.

Text: "The Vertebrate Body", by Romer.

Assignments & Grading: Laboratory examination = 30%
Essay examination = 70%

Prerequisite: Biology N203

NOTE: Students who have credits for Zoology N211 may not take this course for credit.



ZOOLOGY N313 (453)
ANIMAL ECOLOGY (3 credits)

Instructor: E. Maly

Description: Evolutionary, physiological, and mathematical approaches to the study of factors influencing the distribution and abundance of animal populations. Production, animal demography, population dynamics, natural regulation of numbers and social behaviour are the main topics.

Text: Krebs, C. 1972. Ecology. Harper & Row.

Assignments & Grading: 40% for final examination, 40% for term paper and 20% for mid-term examination.

Prerequisite: Biology N213.

NOTE: Students who have credits for Zoology N316 may not take this course for credits.

ZOOLOGY N317 (317)
BIOLOGY OF FISHES (3 credits)

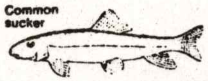
Instructor: P.D. Anderson

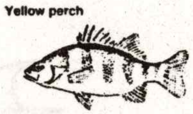
Description: This introduction to fish biology will include a study of anatomy, physiology and classification of the major groups of fishes as well as their ecology and zoogeography. Emphasis will be placed on freshwater fishes. Lecture and Laboratory.

Text: Selected reading list.

Assignments & Grading: Grade based on term papers and final essay examination.

Prerequisite: Biology N213, and Zoology N215.





ZOOLOGY N320 (431)
ANIMAL PHYSIOLOGY (6 credits)

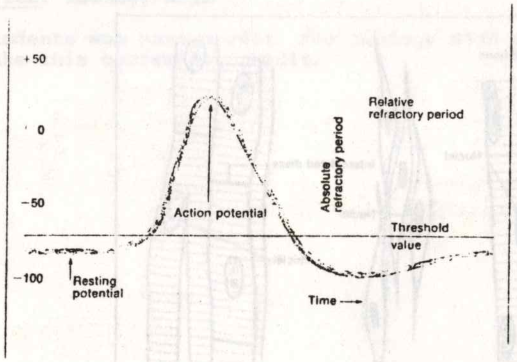
Instructor: P.D. Anderson

Description: A study of comparative animal physiology at the systems level. Lectures and Laboratories.

Text: "General and Comparative Physiology" by Hoar, 1966 or "An Introduction to General and Comparative Animal Physiology" by Florey, 1966.

Assignments & Grading: Approximately 25% of the final grade is based on laboratory reports. The remaining 75% is based on two formal essay type examinations.

Prerequisite: Biology N203 and Chemistry N231.



ZOOLOGY N331 (473)
FUNDAMENTALS OF HISTOLOGY (3 credits)

Instructor: S.M. Ruby

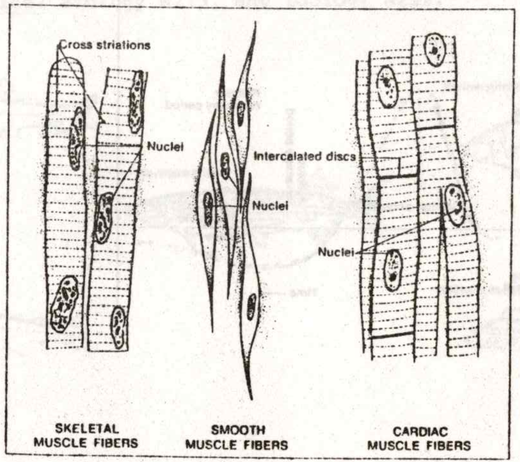
Description: A comparative study of the microscopic characteristics of cells, tissues and organs of the vertebrates. Lectures and Laboratories.

Text: "Histology" by Leeson & Leeson, 2nd edition.

Assignments & Grading:	Final examination	50%
	Laboratory exam	50%

Prerequisite: Biology N203.

NOTE: Students who have credits for Zoology N330 may not take this course for credits.



ZOOLOGY N332 (474)
COMPARATIVE VERTEBRATE HISTOLOGY (3 credits)

Instructor: S.M. Ruby

Description: An advanced comparative study of the vertebrate organ systems at the ultrastructural and histological level. Those registered will be expected to participate in a seminar. Lectures and Laboratories.

Text: "Histology", by Leeson & Leeson, 2nd edition.

Assignments & Grading:	Final examination	40%
	Seminar	20%
	Lab examination	40%

Prerequisite: Zoology N331

NOTE: Students who have credit for Zoology N330 may not take this course for credit.

ZOOLOGY N361 (462)
VERTEBRATE EMBRYOLOGY (3 credits)

Instructor: E. Preddie

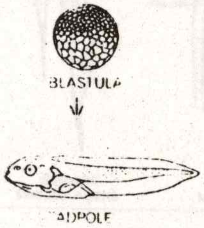
Description: This course focuses on the fundamental processes of growth and development in vertebrates. The emphasis on the first part of the course is on the experimental, physiological and molecular aspect of the various morphogenetic processes. In the second half of the course emphasis is placed on induction and differentiation.

The laboratories will consist of films, group conferences and/or some experiments which will be done in groups. There is no laboratory text required.

Text: "Interacting Systems in Development", 2nd. edition, by Ebert Sussey. Holt, Rinehart and Winston, Inc.
A short list of required and recommended readings will be supplied.

Assignments & Grading: There will be a two or three hour mid-term examination, a short review paper and an optional final examination.

Prerequisite: Second year standing in Biology Majors Programme or permission of the instructor.



ZOOLOGY N421
ADVANCED ANIMAL PHYSIOLOGY

Instructors: Drs. Preddie and Anderson

Description: The subject matter in this course will change in alternate years depending on whether it is given by Dr. Preddie or Dr. Anderson.

Given by Dr. Preddie in the Fall term 1976-77. This course surveys the role of the cell outer membrane in various physiological phenomena which are related to a variety of diseases. The emphasis being placed on neoplastic diseases.

Text: None: Selected reading lists are supplied. Students are required to give formal seminars and participate in general class discussions on assigned topics. About 50% of the course involves formal lectures.

Assignments & Grading: Final marks will be based on a 2 hour mid-term examination and an oral final examination.

Prerequisite: Advanced standing in Biological Sciences.